NASA

Wallops Flight Facility

RF & Microwave Radiation Hazard Awareness

RF Radiation

- Radiation- is energy transmitted through space in the form of electromagnetic waves or sub-atomic particles
- Sources:
  - Radiofrequency (RF) Radiation, Microwaves
  - Infrared, Visible, Ultraviolet Light
  - X-rays and Gamma Rays

RF Radiation

- The term "electromagnetic radiation" is restricted to that portion of the spectrum commonly defined as the radio frequency region, which for our purposes also includes the microwave frequency region.

RF Radiation

- Hazards of Electromagnetic Radiation to Personnel (HERP)
- Hazards of Electromagnetic Radiation to Ordance (HERO)
- Electro Magnetic Interference (EMI)

RF Radiation

- HERP (Effects only possible at ten times the permissible exposure limit)
  - Heating of the body
  - Cataracts
  - Reduced sperm count in males
  - Shocks or Burns

  (Developing fetus is at no greater risk than mother)

RF Radiation

- HERO
  - Premature activation of electroexplosive devices.
- EMI
  - Interference with other electronic equipment

RF Radiation

- Exposure limits are specific for locations that are defined as either controlled or uncontrolled environments.
- Controlled environments are areas where exposure may be incurred by personnel who are aware of the potential for RF exposure as a result of employment or duties; by individuals who knowingly enter areas where higher RF levels can reasonably be anticipated to exist; and by exposure incidental to transient passage through such areas.
- Uncontrolled environments generally include public areas, living quarters and work places where there is no expectation that higher RF levels should be encountered.

RF Radiation Standards

- OSHA 29 CFR 1910.97 (a)(2)(i)
  - For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm^2. (milliwatt per square centimeter) as averaged over any possible 0.1 hour period (6 minute period)

Standards

- OSHA 1910.268 - Telecommunication Industry
  - Primarily safety requirements, such as electrical
  - Mandates 1910.97 compliance for 1-300 GHz
  - Describes “Tagout” of antenna 3-300 MHz
- OSHA 1926.54, 20 - Construction Industry
  - Includes tower erection, repairs and painting
  - Limits MW to 10 mW/cm^2. (no averaging)
  - Requires Programs to provide safe work to employees and contractors; includes inspection

Related Standards

- OSHA 1910.147 - Lockout/Tagout of Power
  - Requires lockout / tagout of power during maintenance to prevent excessive exposures
- OSHA 1910.132 - Personal Protective Equipment
- OSHA 1910.145, 1926.200 - Signs and Tags (Hazard Warning Signs)

Consensus Standards:

The following organizations provide information and guidelines regarding RF use and protection.

- American Conference of Governmental Industrial Hygienists (ACGIH) provides Threshold Limit Values for RF/Microwave Radiation
- Institute of Electronics and Electrical Engineers (IEEE) /American National Standards Institute (ANSI) (U.S.)
- International Commission for Non-Ionizing Radiation Protection (ICNIRP)

Controls:

Controls

- Utilize low exposure equipment & site configuration
  - Use good equipment
  - Control hazard areas
  - Limit exposures
- Access Restriction
- Maintenance of Controls

Controls

- Lockout/Tagout
- Signal Blocking or Blanking
- Prevent access to hazardous locations (Signs & Fences)
- Standard Operating Procedures
- Protective clothing

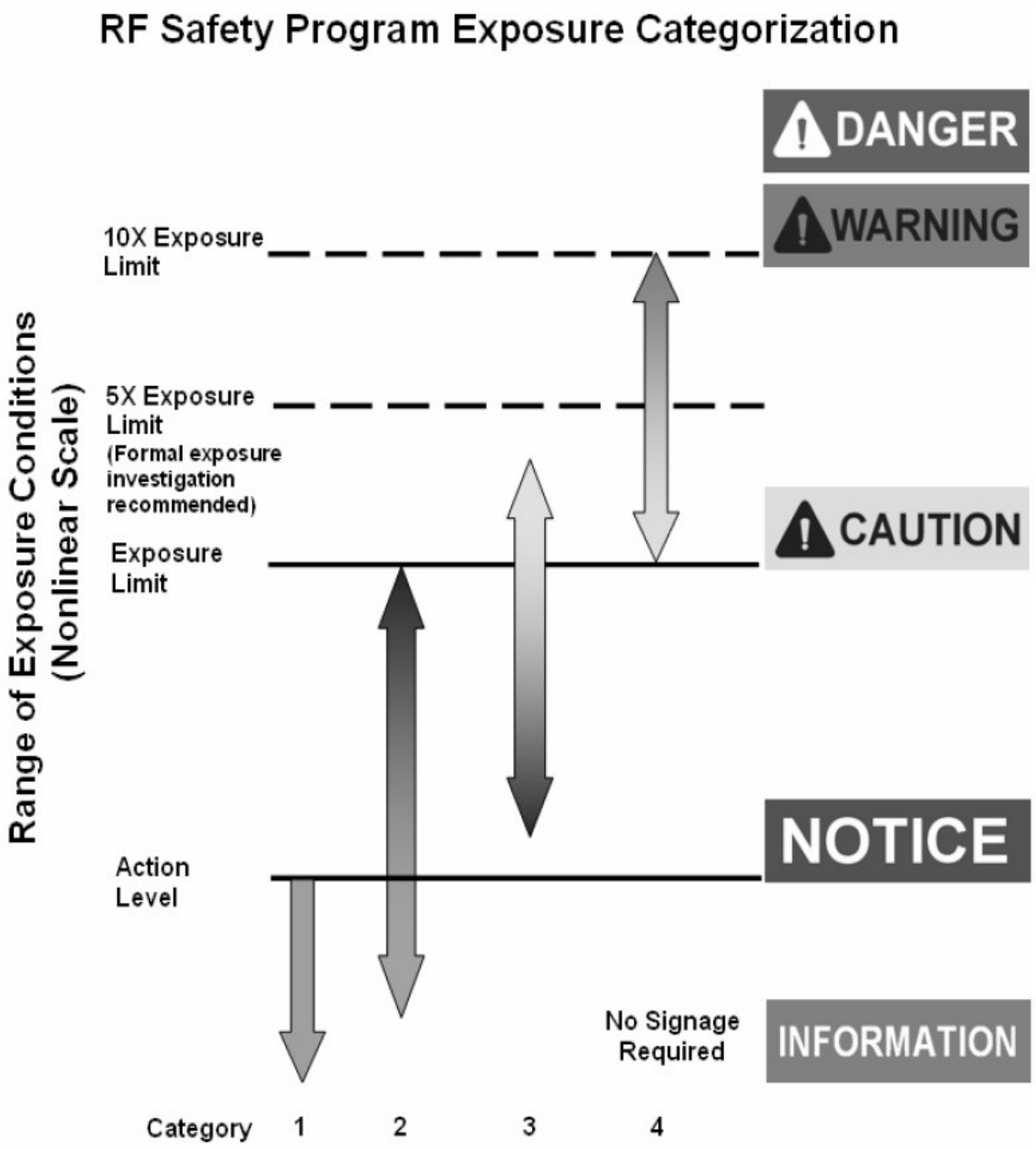
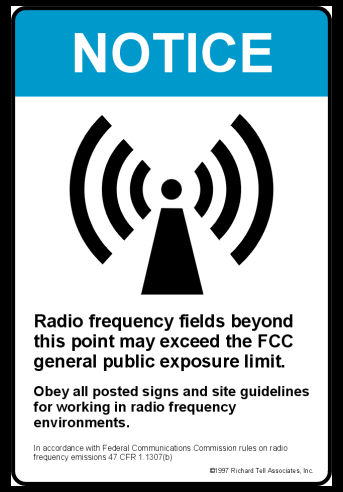


Figure 1–Graphical representation of the RF safety program categorization process corresponding to Table 1 Categories 1-4.



GSFC WFF Safety Program

RF Protection Program

- Radio Frequency Radiation Safety is addressed in GSFC 1860.3
  - RF source equipment are required to meet applicable RF standards when new and during its lifetime.
  - RF hazard identification and periodic surveillance is performed by a competent person.
  - RF Hazard Areas are Identified and Controlled.
  - Controls and SOPs to reduce RF exposures to levels in compliance with applicable guidelines are mandatory.

RF Protection Program

- RF safety and health training is conducted to ensure employees understand the hazards and control methods used.
- Periodic reviews of the program are conducted to identify and resolve deficiencies.
- Workers are encouraged to notify the Safety & Health Office or their local representative whenever potential hazards are identified.

RF Protection Program

- New RF/MW sources are evaluated by the WFF RF Safety Committee.
- Employees are required to be trained in RF Safety and document training using the GSFC form 23-35RF

Emergency

- In the event of an emergency contact 911 from a base phone or 824-1333 from a cell phone.
- For Close Calls or Hazard Reporting contact the Safety & Health Office @ 2559 or 2518.

WFF Sources

AREA (Main Base)	BLDG	RF SOURCE
Radar 18	A-41	1 Mw
ASR-7	N-159	425 Kw
11 Meter	N-162	200w
9 Meter	N-162	200w
6 Meter	N-162	200w
LEO-T	N-162	200w
TOTS	N-162	200w
Satan Command	N-162	10Kw
SCAMP Command	N-162	10Kw

Information courtesy of NENS

WFF Sources

Area (Main Base)	BLDG	RF Source
• MIR VHF	N-162	100w
• VHF 2	N-162	100w
• Water Tower VHF	F-165	100w
• Fire Station VHF	B-129	100w
• VHF	E-7	100w
• Mobile Command Destruct	Trailers	1Kw

Information courtesy of NENS

WFF Sources

Area (Island)	BLDG	RF Source
• Radar 3	Y-55	1 Mw
• Radar 5	U-70	2.5 Mw
• Command Transmitter	U-55	
– UHF (4 xmttrs)		1 Kw
– UHF (2 xmttrs)		4 Kw
– UHF (2 xmttrs)		100w
– HF (2 xmttrs)		1 Kw
– HF (3 xmttrs)		100w
– UHF-VOICE (8 xmttrs)		1-10w, 4-30w, 3-50w

Information courtesy of NENS

What Next?

- After completing this awareness training the worker and supervisor need to complete GSFC form 23-35RF and forward it to the Safety Office – Bldg. E-107 room 107. The form can be found at:

  http://gdms.gsfc.nasa.gov/gdmsnew/srv/GDMSNEWDatabaseObject?document_id=682